An Essay
on
Renal Excretion.

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Renal Excretion.

The various substances which enter into the composition of all organized bodies, are constantly being removed from the system by especial structures, called — Excretory Glands, or rather Organs, — as they do not perform the functions of true glands, being not secretory in their office, but purely excretory — which are adapted for this purpose, and the matters thus rejected, are called — Excretions.

The deficiency produced by this constant outlet, is necessarily replaced by the periodical introduction of food, air and water, which by a series of changes and transformations in the body,

become assimilated to the tissues,— this being the process of Nutrition.

Excretion then, is the necessary consequence of the deterioration which all organized matter undergoes in the vital system — the removal of the wasted material resulting from the "double movement, general and continuous, of composition and decomposition", as M. de Blainville, of the positive school, defines Life to be. Its great and original purpose, is to carry off those products of the metamorphosis of the azotized tissues, which can neither be set free in the condition of carbonic acid and water, through the lungs,— nor got rid of by the liver, in the form of solid biliary matter.

The principal Excretory organs in the body, are,— the Kidneys, the Lungs, the Liver,

immediately after it is discharged, which changes more or less, on being heated — and assumes a strong alkaline smell, when decomposition commences, after standing for several hours, especially in warm weather. The mean specific gravity, is 1024. To take the specific gravity of Urine, the whole quantity passed during the 24 hours, should be collected together. — The average amount excreted in that time by an adult, in a state of health, is estimated at from thirty to forty ounces.

Both the specific gravity and the quantity, are liable to constant changes, owing to the amount of water taken into the system with the drink, the quality of the food used, the temperature of the air, and exercise. — Thus in the winter, for example, when the cutaneous perspiration is not active, the Kidneys are apt

to eliminate more water, and consequently, the urine will be lighter in color, greater in quantity, and so forth. — On the physiological condition of the system, if the urine is greater in quantity, the specific gravity is less, and vice versa.

Composition of Urine.

Water	938.00
Urea	30.00
Creatine	1.25
Creatinine	1.50
Urates of — Soda — Potass — and Ammonia — each	1.80
Uroscaine, Mucus	.30
Biphosphate of Soda; Phosphates of Soda — Potass; " " Magnesia — Lime	12.25
Chlorides of Sodium & Potassium	7.80
Sulphates of Soda & Potass	6.90
	1000.00

Urea, is a crystallizable, nitrogenous substance, very soluble in water, and is readily decomposed, both within and without the body.

As the blood is the source from which the kidneys eliminate it, it exists in the circulation but in a very small quantity, originating from the decomposition of the nitrogenous ingredients of the body, probably in every part.

It is a neutral substance — neither acid, nor alkaline, and is capable of uniting as an acid with bases, and as a base with an acid.

Its quantity in the urine is very variable, depending upon the extent to which the disintegrating process has been carried on in the tissues. It may be increased by any unusual draught upon the muscular system, and also, by the excessive use of nitrogenous compounds as articles of food. Urea is obtained

by evaporating fresh urine in a water bath, to a syrupy consistency, and on adding an equal part of nitric acid, crystals of nitrate of urea will be deposited. Filter, dissolve in water, and precipitate by carbonate of lead, forming nitrate of lead, which remains, and carbonic acid, which goes off as a gas. It may then be purified by dissolving it out by alcohol, and crystallizing by evaporation.

Urea is a fermentable substance, like sugar. When by itself, it will not ferment; but when it comes in contact with a ferment — such as the mucus of the urine — then, the action is set up.

Alone, when crystallized, or in solution in water or alcohol, it may be kept for an indefinite period of time; but if boiled in water, it is decomposed, and each equivalent of urea, absorbs two equivalents of water, and becomes

converted into two equivalents of carbonate of ammonia, thus—

$C_2 H_4 N_2 O_2$ = Urea. NH_3, CO_2 = Carb^e of amm^a.

$H_2 O_2$ = Water. 2

$C_2 H_6 N_2 O_4$ = $N_2 H_6, C_2 O_4$

When urine is exposed for several hours to a temperature of from 70° to 100°, the mucus in it absorbs oxygen from the air, and acts as a ferment, decomposing the urea, and converting it into carbonate of ammonia,— hence the strong ammoniacal odor of putrid urine. It is for this reason, that out of the body, it putrefies with such great rapidity.

When urea is retained in the system by the extirpation of the Kidney, or by placing a ligature around the ureter, such is the septic tendency communicated to the blood,

that signs of decomposition become manifest even during life, and after death, all the soft parts of the body are reduced to a state of putrefaction with extreme rapidity.

The total suppression of the excretion in the body, or the undue retention of the matters to be excreted, produces symptoms like those of a narcotic poison — viz, delirium, coma, insensibility, and so forth; — or produces, or rather induces fevers of a malignant character, in which the symptoms that denote a highly putrid taint in the system, are rapidly developed.

But for the labor of the Kidneys, then — a substance would accumulate in the blood, which would quickly lead to the destruction of life.

Just here, if I may be allowed a slight digression, I would speak a few words

on the extreme importance of the urine, to the physician, when treating fevers of a typhoid or other nature.

I hold it to be not only the duty of every intelligent practitioner of medicine, but also the distinguishing mark and characteristic of an accomplished and well-educated physician, to examine carefully, minutely and systematically, the quantity, quality and pathological condition of the urine of his patient, in any dynamic disease;— for, on the result of this critical examination, can be based both his diagnosis, and his successful prognosis.

Any physician, who could through ignorance, or otherwise, neglect so important a guide as this, to the formation of a correct diagnosis, is not worthy of the honor conferred upon him by his Alma Mater. It is to the man,

what his steam-gauge is to the engineer, which enables him to control - in a measure - and regulate the amount and quality of fuel needed, to keep up the normal status of the motive fluid in the boiler - the analogue of the heart, in the great human machine. It is a hygienic barometer, by means of which, the physician may ascertain the true condition of the functional atmosphere; and finally, as an important adjuvant, as a guide in arriving at a perfect knowledge of the state of the diseased organism, its value can scarcely be over-rated.

But to return to our subject. Another ingredient of the urine, is

Creatine.

This is also a crystallizable and neutral substance, found in the muscles, where it probably originates, and is carried from thence by the blood,

and is finally discharged by the Kidneys, among the other components of the urine.

It is altogether an excrementitious substance, the result of the decomposition of the muscular structure.

Creatinine — differs from the above, in its slight alkaline reaction, and in containing two equivalents less of water. It is found in the muscles, blood and urine. It is believed that Creatine is converted into Creatinine, in its passage to the urine, as in it, the latter is found in greater abundance, than the former.

Urate of Soda.

This is a compound of uric acid and soda, having as its formula — $C_5 H N_2 O_2 . NaO$. Where is the NaO

Uric acid is not present in the urine by itself, but is formed by the decomposition of the

urates. Its great affinity for the bases with which it enters into combination, renders its appearance in the urinary fluid difficult.

In regard to the Urates of Potass and Ammonia, which are found only in a small proportion, they are formed in a manner analogous to the preceding; being salts composed of a conjugated acid and a base. They contain nitrogen, are crystallizable and soluble, and originate from the débris produced by the disintegration of the tissues.

The acid reaction of the urine, depends upon the presence of the Biphosphate of soda, a salt which has an acid reaction.

This ingredient, does not exist in the blood, but it is probably formed at the time when the uric acid is produced, by de-composing the neutral phosphate of soda,

and giving as a result — urate of soda, and an acid biphosphate. The

Phosphates

are all soluble, except those of lime and magnesia, these latter being held in solution by the acid reaction of the biphosphate of soda, and being precipitated the moment that the urine becomes alkaline, gives to it a turbid appearance, which is augmented by the presence of mucus and effete epithelial cells, from the internal coats of the bladder. These phosphates are apt to increase, and their appearance is almost certain, after excessive mental exertion — of which fact, the students of medicine will bear me evidence.

If the urine be boiled when in this condition, the cloudy sediment will disappear, and the liquid will assume its clear,

amber color. The phosphates exist abundantly in the blood, and from the fact of their appearance after mental anxiety, or severe study, we must attribute their origin to the disintegration of the nervous tissues, where the element – phosphorus, is more abundant than in any other part of the body.

Urosacine

is an organic coloring substance, analogous to the biliverdine of the bile, and to the red globules of the blood. It is possible, that it may be composed of the latter in a more advanced state of oxidation, or in an allotropic condition.

The presence of Mucus – in alkaline urine, is owing to the acrid, or stimulating effect of the Ammonia, upon the coats of the bladder.

Chlorides.

They are all soluble by themselves.

These salts are largely introduced into the system with the food, particularly the Chloride of Sodium, which is essential to the health and well-being of the brute-creation, as well as of man; instinct impelling the one class to take it; and the desire to please the palate, - the other. The super-abundance, is eliminated by the Kidneys.

The

Sulphates - of Soda and Potassa, are also found in the urine, being derived from the blood, from whence they are withdrawn when their presence is no longer needed, and voided by the Kidney.

The above enumerated substances, are the normal ingredients of the urinary

excretion.

But the Kidneys being the great sewers of the system, the great gates by which the majority of those solid principles which are not further needed in the organism, pass out of the body, — we find accidentally other substances which have their outlet through the same channel. These — are — the pure alkalies and their carbonates, — ferrocyanide of potassium — iodine, in all its combinations — ether — vegetable alkaloids, such as Quinine — Strychnia, &c, and other substances of a poisonous nature; whether they have been taken into the system habitually, or as medicinal agents.

They can be recognized in the urine by the senses, or by chemical tests. It is said, that in

the East Indies, there grows a species of mushroom called - Agaricus Muscarius, which possesses intoxicating properties, and those who partake of it, experience sensations similar - though not in so marked and peculiar a degree - to those observed by the opium-eater. The active principle of this drug, is preserved so intact during its passage through the system, that after its discharge by the Kidney, individuals will become intoxicated the second time, by drinking their own urine.

In some pathological conditions of the system, sugar, and albumen may be found in the renal secretion, even in considerable quantities.

In former times, the causes of these abnormal conditions were not appreciated,

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neither was any cure for them known:

but now, thanks to the extensive researches of Physiologists, — not only these diseases, but all the others to which humanity is liable, are better understood, and will continue to be more and more thoroughly investigated in future times; — as all knowledge of disease, from the remotest periods to the present, — has been based upon the existing physiological knowledge of the day.